CLAIMS:

1. An isolated graphitic polyhedral crystal comprising graphite sheets arranged in a plurality of layers to form an elongated structure having a long axis and a diameter and having 7 or more external facets running substantially the length of the long axis.
2. The isolated graphitic polyhedral crystal of claim 1, wherein the crystal has from 7 to 14 external facets.
3. The isolated graphitic polyhedral crystal of claim 2, wherein the crystal has 7, 9 or 11 external facets.
4. The isolated graphitic polyhedral crystal of claim 3, wherein the crystal has 9 external facets.
5. The isolated graphitic polyhedral crystal of claim 1, wherein said diameter is from 5 nm to 1000 nm.
6. The isolated graphitic polyhedral crystal of claim 1, wherein said long axis is from 100 nm to 5 microns in length.
7. The isolated graphitic polyhedral crystal of claim 1, wherein the crystal is in a form selected from the group consisting of needles, giant nanotubes, rings, cones, double tipped pyramids, nanorods and whiskers.
8. The isolated graphitic polyhedral crystal of claim 1, wherein said external facets run axially true.
9. The isolated graphitic polyhedral crystal of claim 1, wherein said external facets undergo at least a partial helical twist along the length of the long axis.
10. The isolated graphitic polyhedral crystal of claim 7, wherein the crystal is in the form of a needle.

11. The isolated graphitic polyhedral crystal of claim 7, wherein the crystal is in the form of a giant nanotube.

12. The isolated graphitic polyhedral crystal of claim 7, wherein the crystal is in the form of a ring.

13. The isolated graphitic polyhedral crystal of claim 7, wherein the crystal is in the form of a cone.

14. The isolated graphitic polyhedral crystal of claim 7, wherein the crystal is in the form of a double tipped pyramid.

15. The isolated graphitic polyhedral crystal of claim 7, wherein the crystal is in the form of a nanorod.

16. The isolated graphitic polyhedral crystal of claim 7, wherein the crystal is in the form of a whisker.

17. A method for isolating graphitic polyhedral crystals, comprising:

treating a glassy carbon product comprising a matrix and pores encapsulated therein, in water at a temperature and pressure and for a time sufficient to dissolve the matrix to leave the encapsulated pores;

fracturing said encapsulated pores; and

removing said graphitic polyhedral crystals contained therein.

18. The method of claim 17, wherein said treating step is performed at a temperature of from 300°C to 1000°C.

19. The method of claim 17, wherein said treating step is performed at a pressure of from 1 to 2000 atm.

20. The method of claim 17, wherein said treating step is performed for a time of from 1 to 100 h.

21. The method of claim 17, wherein said treating step is performed under supercritical water conditions.

22. A method for isolating graphitic polyhedral crystals, comprising:

- a step of treating a glassy carbon product comprising a matrix and pores encapsulated therein to dissolve the matrix and leave the encapsulated pores;
- a step of fracturing said encapsulated pores; and
- a step of removing said graphitic polyhedral crystals from said fractured encapsulated pores.

23. The method of claim 22, wherein said step of treating is performed at a temperature of from 300°C to 1000°C.

24. The method of claim 22, wherein said step of treating is performed at a pressure of from 1 to 2000 atm.

25. The method of claim 22, wherein said step of treating is performed for a time of from 1 to 100 h.

26. The method of claim 22, wherein said step of treating is performed under supercritical water conditions.

27. A microscopy probe comprising a graphitic polyhedral crystal having a plurality of graphite sheets arranged in a plurality of layers to form an elongated structure having a long axis and a diameter and having 7 or more external facets running substantially the length of the long axis, and having protruding from one end thereof a nanotube.

28. A nanoscale gear assembly, comprising a graphitic polyhedral crystal comprising graphite sheets arranged in a plurality of layers to form an elongated structure having a long axis and a diameter and having 7 or more external facets running

substantially the length of the long axis, wherein the crystal is in the form of a ring having a hollow center, through which is placed a nanorod as an axle.

29. A nanoscale screw/traveler device, comprising a nanoscale screw means and a nanoscale traveler means, wherein said traveler means is in contact with at least a portion of an external surface of said screw means and will be caused to travel in a direction of a long axis of the screw means as the screw means rotates.

30. The nanoscale screw/traveler device of claim 29, wherein said screw means is a graphitic polyhedral crystal comprising graphite sheets arranged in a plurality of layers to form an elongated structure having a long axis and a diameter and having 7 or more external facets running substantially the length of the long axis, wherein said external facets undergo at least a partial helical twist along the length of the long axis.

31. A reinforced matrix composite, comprising a matrix and a reinforcement, wherein said matrix is a member selected from the group consisting of ceramics, metals and polymers, and wherein said reinforcement is a graphitic polyhedral crystal comprising graphite sheets arranged in a plurality of layers to form an elongated structure having a long axis and a diameter and having 7 or more external facets running substantially the length of the long axis.

32. The reinforced matrix composite of claim 31, wherein the crystal has from 7 to 14 external facets.

33. The reinforced matrix composite of claim 32, wherein the crystal has 7, 9 or 11 external facets.

34. The reinforced matrix composite of claim 33, wherein the crystal has 9 external facets.

35. The reinforced matrix composite of claim 31, wherein said diameter is from 5 nm to 1000 nm.

36. The reinforced matrix composite of claim 31, wherein said long axis is from 100 nm to 5 microns in length.

37. The reinforced matrix composite of claim 31, wherein the crystal is in a form selected from the group consisting of needles, giant nanotubes, rings, cones, double tipped pyramids, nanorods and whiskers.

38. The reinforced matrix composite of claim 31, wherein said external facets run axially true.

39. The reinforced matrix composite of claim 31, wherein said external facets undergo at least a partial helical twist along the length of the long axis.

40. The reinforced matrix composite of claim 37, wherein the crystal is in the form of a needle.

41. The reinforced matrix composite of claim 37, wherein the crystal is in the form of a giant nanotube.

42. The reinforced matrix composite of claim 37, wherein the crystal is in the form of a ring.

43. The reinforced matrix composite of claim 37, wherein the crystal is in the form of a cone.

44. The reinforced matrix composite of claim 37, wherein the crystal is in the form of a double tipped pyramid.

45. The reinforced matrix composite of claim 37, wherein the crystal is in the form of a nanorod.

46. The reinforced matrix composite of claim 37, wherein the crystal is in the form of a whisker.

47. The reinforced matrix composite of claim 31, wherein the matrix is a ceramic.

48. The reinforced matrix composite of claim 31, wherein the matrix is a metal.

49. The reinforced matrix composite of claim 31, wherein the matrix is a polymer.